Did climate change cause Typhoon Haiyan?

A large ship that washed ashore in Tacloban, the Philippines, on 10 November during Typhoon Haiyan — the most violent tropical storm on record.

Aaron Favila/AP Photo

As the Philippines assesses the havoc caused by super-typhoon Haiyan, which according to some reports killed as many as 10,000 people, speculation is heating up as to whether the disaster might be a manifestation of climate change. Speaking today at the first day of UN climate talks in Warsaw, the head of the Philippines delegation, Yeb Sano, said he will stop eating until negotiators make "meaningful" progress.

But can the devastating storm be linked to the changing global climate? *Nature* wades into the evidence.

Was Haiyan the strongest storm ever measured?

Apparently, yes. With sustained wind speeds of more than 310 kilometres per hour, Haiyan was the most powerful tropical cyclone to make landfall in recorded history. The previous record was held by Hurricane Camille, which in 1969 hit the state of Mississippi with wind speeds of just over 300 km/h.

It is the third time that disaster has struck the Philippine archipelago in less than 12 months. In August, typhoon Trami caused massive flooding on the island of Luzon. And in December 2012, typhoon Bopha killed up to 2,000 and caused some US$ 1.7 billion in damage on the island of Mindanao. Haiyan could easily surpass that figure: according to a report by a senior analyst at Bloomberg Industries, citing Kinetic Analysis Corp., Typhoon Haiyan's total economic impact may reach US$ 14 billion.

The death toll might have been much bigger had many Philippines not heeded the storm warnings and fled at-risk areas in time.

What's the difference between a cyclone, a typhoon and a hurricane?

They are basically just different names for the same extreme weather phenomena in different parts of the world. These storms are called 'hurricanes' In the Atlantic and Northeast Pacific, 'typhoons' in the Northwest Pacific and 'cyclones' in the South Pacific and Indian Ocean.

Are such storms getting worse in a warming world?

This is the one-million-dollar question, and there is no scientific consensus on how to answer it yet. Storms receive their energy from the ocean, so it would seem logical that they would get stronger, and perhaps also more frequent, as the upper layers of the tropical oceans warm. Indeed, the potential intensity of tropical storms does increase with warmer sea-surface temperatures. However, the effect of warming seas could be counteracted by the apparent increase in the strength of shear winds — winds blowing in different directions and varying strength at different altitudes. Shear winds tend to hinder the formation of storms, or tear them apart before they

can reach extreme strength.

On balance, many climate researchers think it is plausible to assume that tropical storm activity will rise. Some evidence exists that storm intensity has indeed increased, but it is limited to the North Atlantic, where observations are most abundant. In other places, the available evidence is not yet conclusive.

The Intergovernmental Panel on Climate Change (IPCC) in its last report cautiously summarizes the state of knowledge as follows:

"Time series of cyclone indices such as power dissipation, an aggregate compound of tropical cyclone frequency, duration, and intensity that measures total wind energy by tropical cyclones, show upward trends in the North Atlantic and weaker upward trends in the western North Pacific since the late 1970s, but interpretation of longer-term trends is again constrained by data quality concerns."

What are the models saying?

Global climate models are too coarse to resolve relatively small-scale atmospheric disturbances such as tropical storms — despite how prominently these phenomena feature on weather maps. Scientists therefore need to infer the effect of global warming on storm activity from general patterns of atmospheric circulation.

For example, hurricane researcher Kerry Emanuel of the Massachusetts Institute of Technology in Cambridge has used a new technique for simulating large numbers of tropical cyclones in climate models. When applied to scenarios of historical and future climate described by six state-of-the-art climate models, his method forecast that both the frequency and intensity of tropical cyclones will increase during the 21st century in all tropical oceans regions, except the south-western Pacific. Emanuel's study was published too late for inclusion in the last IPCC report.